M.Sc. Mathematics

Employability **Entrepreneurship** **Skill Development**

Name of the Programme	Course Code	Title of the Course	Employability	Entrepreneurship	Skill Development
M.Sc. Mathematics		MBE IV -Optimization Techniques	✓		
		EC I- Advanced Numerical Analysis			✓
		CC XIII – Probability Theory	✓		
	PGMB	Real Analysis	✓		
	PGMA	Algebra	✓		
	PGMC	Ordinary Differential Equation	✓		
	PGMD	Advanced Graph Theory	✓	✓	✓
	PGME1	Advanced Numeric Analysis			✓
	PGME	Complex Anal;ysis	✓		
	PGMF	Linear algebra	✓		
	PGMG	Partial Differential Equations	✓		✓

M.Sc. Mathematics	PGMH	Classical Dynamics	✓		✓
	PGME2	Fuzzy Sets and its Applications	✓	✓	✓
	PGMI	Measure and Integration	✓		✓
	PGMJ	Topology	✓		
	PGMK	Integral Equations and Transforms	✓		
	PGME3	Mathematical Modeling	✓	✓	✓
	PGME4	Advanced Operations Research		✓	✓
	PGML	Functional analysis	✓		
	PGMM	Advanced Probability Theory	✓		✓
	PGMN	Fluid Dynamics			✓
	PGME5	Differential Geometry	✓		
	PGMP	Project	✓		✓

Semester-III/ Elective Course-IV (EC IV)	Optimization Technique	Course Code: MME4
Instruction Hours: 6	Credits: 4	Exam Hours: 3
Internal Marks:25	External Marks:75	Total Marks: 100

Cognitive Level	**K 1 -** Acquire/ Remember **K2 -** Understand **K3** - Apply **K4** - Evaluate **K5** - Analyze **K6** - Create	
Course Objectives	**The Course aims** • To introduce the applications and algorithms in the field of operations research. • To understand the OR techniques in business and management problems. • To know the optimization techniques like integer programming, dynamic programming, decision theory and game theory. • To learn the concept of inventory models. • To study the non-linear programming algorithms.	
UNIT	**CONTENT**	**HOURS**
UNIT I	**Integer Linear Programming** Introduction - Illustrative Applications – Integer Programming Solution Algorithms – Branch and Bound Method – Zero – One Implicit enumeration Algorithm – Cutting Plane Algorithm	**18**
UNIT II	**Dynamic (Multistage) Programming** : Elements of the DP Model:The Capital Budgeting Example–More on the Definition of the State–Examples of DP Models and Computations–Problem of Dimensionality in Dynamic	**18**

	Programming – Solution of Linear Programs by Dynamic Programming.	
UNIT III	**Inventory Models**: The ABC Inventory System – A Generalized Inventory Model – Deterministic Models.	**18**
UNIT IV	**Queueing Models** : Basic Elements of the Queueing Model – Role of the Poisson and Exponential Distributions –Pure Birth and Pure Death Processes– Queues with Combined Arrivals and Departures– Specialized Poisson Queues.	**18**
UNIT V	**Nonlinear Programming Algorithms** Unconstrained Nonlinear Algorithm.	**18**

Text Books:

1.Hamdy A. Taha , Operations Research, Prentice hall of India, Sixth Edition.

Reference Books:

1. O.L. Mangasarian, Non Linear Programming, McGraw Hill, New York.
2. S. MoktherBazaraa and C.M. Shetty, Non Linear Programming, Theory and Algorithms, Willy, New York .
3. Prem Kumar Gupta and D.S. Hira, Operations Research-An Introduction, S.Chand and Company.

Web – Resources:

http://www.ru.ac.bd/stat/wp-content/uploads/sites/25/2019/03/405_01_Srinivasan_Operations-Research_-Principles-and-Applications-Prentice-Hall-of-India-2010.pdf

Course Outcomes

On Completion of the Course, Students should be able to

CO1 : write the algorithms in integer programming problem.

CO2 : apply the OR techniques in various models.

CO3 : analyse the problems on decision theory and game theory

CO4 : optimize solutions of inventory models.

CO5 : intrepret the concepts of non-linear programming problems.

Semester-I / Elective Course-I (EC)	Advanced Numerical Analysis	Course Code: MME1

Mapping of Course outcomes with Programme Outcomes/ Programme Specific Outcomes

CO/PO	PO					PSO				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

S - Strongly Correlated
M - Moderately Correlated
W-Weakly Correlated
N – No Correlation

Instruction Hours:	**Credits: 4**	**Exam Hours: 3**
Internal Marks:25	**External Marks:75**	**Total Marks: 100**

Text Books:

Cognitive Level	**K 1 -** Acquire/ Remember **K2 -** Understand **K3** - Apply **K4** - Evaluate **K5** - Analyze **K6** – Create	
Course Objectives	**The Course aims** • To demonstrate the concepts of Numerical methods. • To study the iteration methods for solving matrices. • To know about interpolations. • To learn the methods based on interpolation. • To study the ordinary differential equations numerically.	
UNIT	**CONTENT**	**HOURS**
UNIT I	**Transcendental and Polynomial Equations:** Introduction – Bisection Method – Iteration Methods Based on First Degree Equation – Iteration Methods Based on Second Degree Equation – Rate of Convergence – Polynomial Equations.	**18**
UNIT II	**System of Linear Algebraic Equations and Eigen Value Problems:** Iteration Methods - Eigen values and Eigenvectors: Jacobi Method for Symmetric Matrices – Givens Method for Symmetric Matrices – Power Method.	**18**
UNIT III	**Interpolation and Approximation:** Higher Order Interpolation - Hermit Interpolations – Bivariate Interpolation – Least Squares Approximation	**18**
UNIT IV	**Differentiation and Integration:** Methods Based on Interpolation – Extrapolation Methods – Partial differentiation – Numerical Integration – Methods Based on Interpolation – Methods Based on Undetermined Coefficients –Composite Integration Methods.	**18**
UNIT V	**Ordinary Differential Equations:** Numerical Methods – Single Step Methods – Multistep Methods.	**18**

1.M.K.Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation , New Age International (P) Limited , New Delhi,2003.

Reference Books:

1.S.S. Sastry, Introductory Methods of Numerical Analysis, Prentice Hall of India PVT Limited, New Delhi, 1994.

2.Joe D. Hoffman, Numerical Methods for Engineers and Scientists, Second Edition, CRC Press, 2001.

Web – Resources:

1https://web.njit.edu/~jiang/math614/atkinson2.pdf
2.https://www.epfl.ch/labs/anchp/index-html/teaching/advancedna/

Course Outcomes

On Completion of the Course, Students should be able to

CO1 :Solve transcendental and polynomial equations.

CO2 :Determine the solution of linear equations.

CO3 :Evaluate the higher order interpolation.

CO4 :Estimate the numerical differentiation and integration.

CO5 :Interpret the methods of solving integration numerically

Mapping of Course outcomes with Programme Outcomes/ Programme Specific Outcomes

CO/PO	PO						PSO					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	M	S	M	S	M	M	M	M	S	S	M	S
CO2	M	S	M	S	M	M	M	M	S	S	M	M
CO3	S	S	S	S	M	M	M	M	S	S	M	S
CO4	M	S	S	M	S	M	S	S	S	S	S	S
CO5	S	S	M	M	M	M	S	M	S	M	S	S

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Semester-IV /	**Probability Theory**	**Course Code: MMM**

Core Course-XIII (CC)		
Instruction Hours: 6	**Credits: 5**	**Exam Hours: 3**
Internal Marks:25	**External Marks:75**	**Total Marks: 100**

Cognitive Level	**K 1 -** Acquire/ Remember **K2 -** Understand **K3** - Apply **K4** - Evaluate **K5** - Analyze **K6** - Create	
Course Objectives	**The Course aims** • To understand the fields, σ -fields and random variables. • To provide the knowledge of the expectations, convergence in random variables. • To learn the estimation • To gain knowledge about MGF and limit theorems. • To study the different types of distributions	
UNIT	**CONTENT**	**HOURS**
UNIT I	Axioms Of Probability–sample space and events–Axioms of probability–some propositions–equally likely outcomes –probability as a continuous set function – probability as a measure of belief	**18**
UNIT II	Conditional Probability and Independence–Conditional probabilities – Baye's formula – Independent events – P(.IF) is a probability.	**18**
UNIT III	Random variables–Distribution functions–Discrete random variables – Expected value – Expectation of a function of random variable–Variance–Bernoulli and Binomial random variables	**18**
UNIT IV	Continuous random variables – Expectation and variance of continuous random variables– The uniform and normal random variables–Exponential random variables–Other Continuous Distribution.	**18**
UNIT V	Jointly Distributed Random Variables – Joint distribution functions–Independent random variables–Their sums–	**18**

	Conditional distributions	

Text Books:

- Sheldon Ross, A first course in Probability, Maxwell MacMillan international edition, Fifth edition Newyork,1989.

Reference Books:

- Chandra T.K and Chatterjee D. (2003), A first course in probability , 2nd Edition, Narosa Publishing House, New Delhi.
- Kailai Chung and Farid Aitsahlia, Elementary Probability, Springer Verlag 2003, New York.
- Capinski and Thomasz Zastawniak(2003), Probability through problems, Springer Verlag, New York.
- Sharma .T.K(2005), A text book of probability and theoretical distribution, Discovery publishing house, New Delhi.

Web – Resources:

- **https://ieeexplore.ieee.org/document/6813036?arnumber=6813036**
- **https://www.degruyter.cpcom/document/doi/10.1515/9783110466195/html?lang=en**

Course Outcomes

On Completion of the Course, Students should be able to

CO1 : interpret the field and σ – fields

CO2 : analyze the probability spaces.

CO3 : apply the concepts of random variables and distributions.

CO4 : describe the ideas of expectation and characteristic functions

CO5 : demonstrate the convergence of random variables

Mapping of Course Outcomes with Programme Outcomes / Programme Specific Outcomes

CO/PO	PO					PSO				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

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